

ISLAMIC UNIVERSITY OF GAZA

FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL ENGINEERING

DIGITAL COMMUNICATION
EELE 4370

MID-TERM EXAMINATION

INSTRUCTORS:
DR .FADI AL NAHAL
T.A: ALAA ABU AUDA.
T.A:ROBA ABU ELEIS
TIME: 100 MINUTE

STUDENT NAME : ID:

PROBLEM #	MAXIMUM POINT	EARNED POINT
1.	10	
2.	05	
3.	30	
4.	15	
TOTAL POINT	60	

GOOD LUCK

PROBLEM #1: (10%)

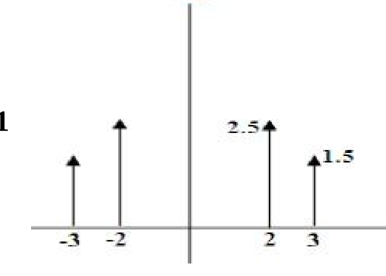
A signal x (t) = 5cos (4000πt) +3cos (6000πt)

1. Is the signal x (t) a power or an energy signal? Calculate the appropriate quantity (Energy or power)? 1%

2. Determine the Nyquist rate and the Nyquist interval? 1%

3. Assume the signal spectrum shown in Figure1, the signal sampled with fs=8 kHz, sketch spectrum of sampled signals? 1%

Figure1



4. If the signal x(t)is sampled at 2.5 times the Nyquist rate ,the signal is quantized uniformly so that the ratio of the peak signal power to the average quantization noise power is at least 60 dB, if the signal is to be transmitted over 64-aray PAM system.

a) What is the minimum number of bits required to encode each sample? 3%

b) The actual peak signal power to the average quantization noise power ratio in dB? 1%

5. If the quantization error has the following probability density function, repeat part a? 3%

$$p(e) = \begin{cases} \frac{1}{2q^2}, & 0 \le e \le \frac{q}{2} \\ 0, & other\ wise \end{cases}$$

PROBLEM#2: 5%

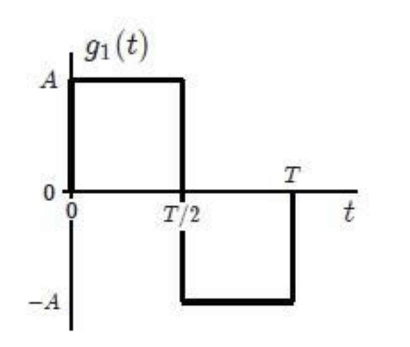
For equally likely binary transmission, the probabilities $p(z\,|\,s1)$, $p(z\,|\,s2)$ are given shown below, where b is positive constant.

$$p(z\,|\,s1) = \frac{\frac{b}{\pi}}{b^2 \quad +(z-\sqrt{Es})^2} \quad p(z\,|\,s2) = \frac{\frac{b}{\pi}}{b^2 \quad +(z+\sqrt{Es})^2}$$

- Determine the MAP decision criterion, simplify as much as possible

PROBLEM #3: (30%)

In a binary communications system, the bits are equally likely transmitted over an AWGN channel with a double sided power spectral density No/2 W/Hz. The system uses the waveforms shown in Figure 2 to transmit zeros and ones.



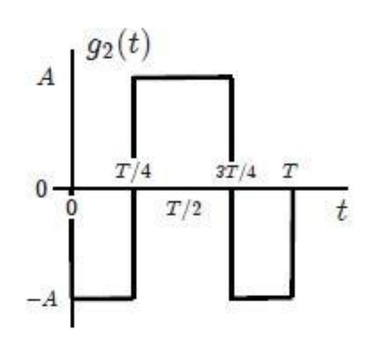


Figure 2

1. Find the average bit energy and cross correlation coefficient ρ? 4%

2. Find and sketch orthonormal basis functions for the signal set?4%

3. Sketch the signal space showing g1 (t) and g2 (t) and the optimum decision regions? 2%

4. Draw the block diagram of the optimum receiver using Two correlators?2%

5. Find the optimum decision threshold? 5%

6. Find the power of the noise that seen by the detector in terms of A, T, N0? 2%

7. Find the probability of error in terms of A, T, N0 by two methods? 4%

8. If the following wave shown in Figure3 is receive by Two correlators receiver What are the detected symbols? 3%

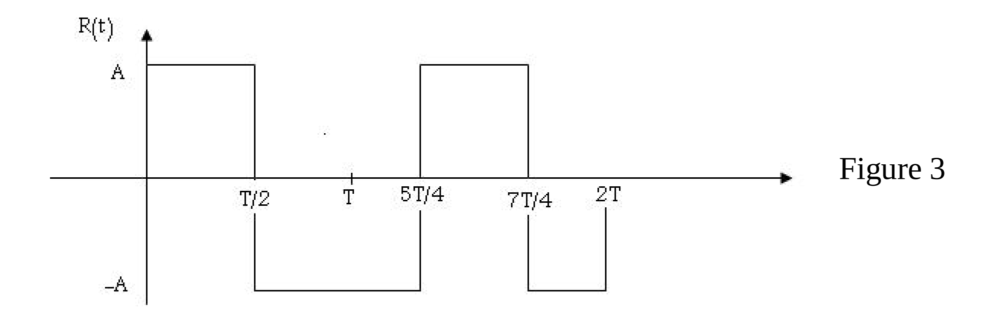


Figure 3

9. Find the new optimum decision threshold if the receiver in Figure4 are used to receive g1 (t), g2 (t)? 4%

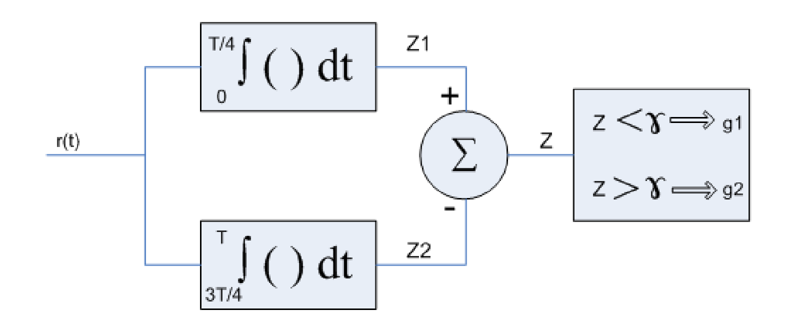


Figure 4

PROBLEM #4: (15%)

Four equiprobable messages s1 (t), s2 (t), s3 (t), s4 (t) shown in Figure5 are to be transmitted over AWGN channel with a double sided power spectral density No/2 W/Hz

1. Determine and sketch a set of orthonormal basis functions? 4%
   Hint: (You may use inspection.)

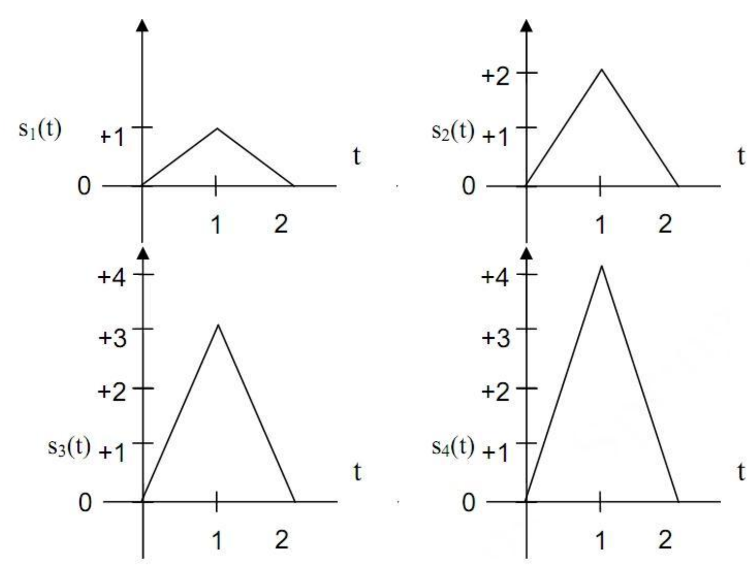


Figure 5

2. Find average symbols energy Es? 2%

3. Plot the signal space in term of Es for the set and draw the optimum decision regions? 3%

4. Find the probability of symbol error P_{e1}, P_{e2}, P_{e3} and P_{e4} ? 6%